

## Description of Two New Species of *Gyrodactylus* von Nordmann, 1832 (Monogenea) from Cultured Nile Tilapia, *Tilapia nilotica* (Cichlidae), in the Philippines

DAVID K. CONE,<sup>1</sup> J. RICHARD ARTHUR,<sup>2</sup> AND MELBA G. BONDAD-REANTASO<sup>3,4</sup>

<sup>1</sup> Department of Biology, Saint Mary's University, Halifax, Nova Scotia, Canada B3H 3C3,

<sup>2</sup> Maurice Lamontagne Institute, Fisheries and Oceans, P.O. Box 1000, Mont-Joli, Quebec, Canada G5H 3Z4, and

<sup>3</sup> Bureau of Fisheries and Aquatic Resources, Fish Health Section, 860 Quezon Avenue, Quezon City, Metro Manila 3008, Philippines

**ABSTRACT:** Two new species of *Gyrodactylus* von Nordmann, 1832 (Monogenea) are described from the body surface of Nile tilapia (*Tilapia nilotica*) (Cichlidae) from fish farms in the Philippines. One species, *G. shariffi* sp. n., occurs on fish in brackish water ponds. It resembles species of *Gyrodactylus* reported from mullets (Mugilidae) in other regions of the Pacific and may represent a parasite that *T. nilotica* has acquired from mullets enzootic to coastal waters of the Philippines. The other species, *G. niloticus* sp. n., occurs on fish cultured in freshwater ponds. It resembles species of *Gyrodactylus* described from freshwater fishes (cichlids, characids, and cyprinodontids) in Africa and is believed to have been introduced into the Philippines along with shipments of Nile tilapia from stocks originating on that continent.

**KEY WORDS:** *Gyrodactylus niloticus* sp. n., *Gyrodactylus shariffi* sp. n., morphology, taxonomy.

To date, there are 348 named species of *Gyrodactylus* von Nordmann, 1832 (Monogenea) described from teleost fishes and amphibians. Only one of these, *G. plotosi* Mayes and Brooks, 1977, has been described from a host fish originating from the Philippine Archipelago (Mayes and Brooks, 1977). The only other reports of these parasites from the Philippines involve unidentified species listed only as *Gyrodactylus* sp. (see Lumanlan and Arthur, 1992).

During a study of parasites of Nile tilapia (*Tilapia nilotica*) raised at fish farms at 2 sites in the Philippines, 2 undescribed species of *Gyrodactylus* were found. The present study describes this new material as *Gyrodactylus niloticus* sp. n. and *Gyrodactylus shariffi* sp. n.

### Materials and Methods

Specimens of *Gyrodactylus* examined were collected during an extensive study of parasites of cultured Nile tilapia throughout the Philippines, the procedures of which have been described elsewhere (Natividad et al., 1986; Bondad-Reantaso and Arthur, 1990). Species of *Gyrodactylus* from 2 areas, 1 a freshwater site (culture ponds at the Bureau of Fisheries and Aquatic Resources, National Freshwater Fish Hatchery, Muñoz, Nueva Ecija Province) and the other a brackish water site (culture ponds at the University of the Philippines in the Visayas Brackishwater Aquaculture Center, Le-

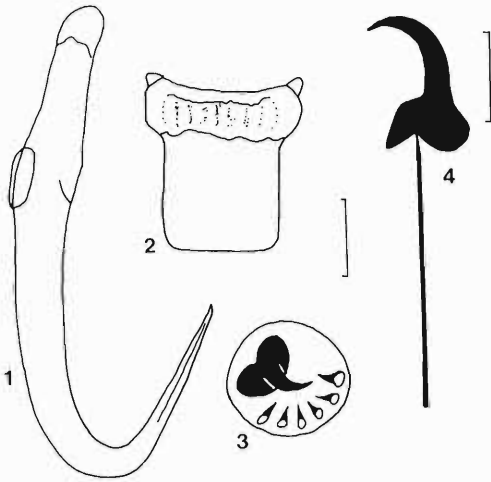
ganes, Iloilo Province) are described herein. Formalin-fixed specimens were mounted individually in glycerine jelly and, when cleared, examined microscopically. Pertinent morphometric measurements were calculated from drawings prepared with the aid of a drawing tube. Enlarged photomicrographs of the marginal hooks were used to prepare the detailed drawings of the marginal hook sickle. The morphometrics follows that of Malmberg (1970). Measurements are given in micrometers ( $\mu$ m) and are presented as the range followed by the mean  $\pm$  1 SD in parentheses.

### Results

#### *Gyrodactylus niloticus* sp. n. (Figs. 1–4)

**DESCRIPTION** (based on 9 flattened specimens): Body 360–416 ( $388.7 \pm 21.1$ ) long, 64–128 ( $87.1 \pm 24.5$ ) wide at middle. Pharynx 22–39 ( $26.0 \pm 4.0$ ) ( $n = 8$ ) long, 24–35 ( $27.9 \pm 4.6$ ) wide. Penis 10–14 ( $11.4 \pm 1.9$ ) ( $n = 7$ ) in diameter, with 1 large spine and a row of 4–6 small spines. Hamuli relatively slender, 59–66 ( $61.3 \pm 2.3$ ) ( $n = 8$ ) long; root 17–25 ( $20.6 \pm 2.6$ ) ( $n = 8$ ), shaft 42–45 ( $43.8 \pm 1.0$ ) ( $n = 8$ ), point 22–28 ( $25.6 \pm 1.9$ ) ( $n = 7$ ). Ventral bar 5–7 ( $6.2 \pm 0.7$ ) long, 20–22 ( $21.1 \pm 0.9$ ) wide, with small, inconspicuous anterolateral processes 2 ( $2.0 \pm 0.0$ ) long. Ventral bar membrane almost square, 13–14 ( $13.8 \pm 0.4$ ) long. Dorsal bar 14–22 ( $20.0 \pm 2.6$ ) ( $n = 8$ ) wide. Marginal hook 23–29 ( $27.1 \pm 1.9$ ) ( $n = 8$ ) long. Sickle 7–8 ( $7.7 \pm 0.5$ ) long, 3–4 ( $3.8 \pm 0.5$ ) ( $n = 8$ ) wide proximally, 4–6 ( $4.5 \pm 0.8$ ) ( $n = 8$ ) wide distally, with slender blade. Handle 17–21

<sup>4</sup> Present address: Department of Fisheries, Faculty of Agriculture, The University of Tokyo, Yayoi 1-1-1, Bunkyo-Ku 113, Tokyo, Japan.



Figures 1–4. Pertinent morphological features of *Gyrodactylus niloticus* sp. n. 1. Hamulus. 2. Ventral bar. 3. Penis. Scale bar = 10  $\mu$ m. 4. Marginal hook. Scale bar = 5  $\mu$ m.

(19.9  $\pm$  1.4) ( $n$  = 8) long, with no terminal swelling. Filament 9–11 (10.0  $\pm$  1.4) ( $n$  = 2) long.

TYPE HOST: *Tilapia nilotica*, Nile tilapia, (Cichlidae).

TYPE LOCALITY: Culture Ponds at the Bureau of Fisheries and Aquatic Resources National Freshwater Fish Hatchery, Muñoz, Nueva Ecija Province, Philippines.

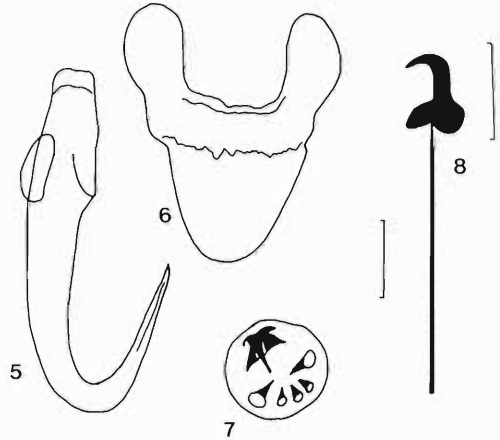
LOCATION: Body surface.

TYPE SPECIMENS: Holotype (No. 84007) and paratype specimens (No. 84008) are deposited in the United States National Museum, Beltsville, Maryland.

COLLECTION DATE: November 1985.

ETYMOLOGY: This species is named after the host from which it was collected.

COMMENTS: *Gyrodactylus niloticus* sp. n. resembles numerous species of the genus (e.g., *G. cichlidarum* Paperna, 1968; *G. microalestis* Paperna, 1968; *G. cytophagus* Paperna, 1968) described from African freshwater fishes including native cichlids, characids, and cyprinodontids (Paperna, 1968). In fact, all of these species, as well as *G. niloticus* sp. n., appear to represent members of the same lineage and are characterized by possessing relatively long, narrow hamuli, a ventral bar with small anterolateral processes and an almost square posterior membrane, and marginal hooks with relatively large slender sickles. This lineage or species group has not been reported from freshwater fishes outside of the



Figures 5–8. Pertinent morphological features of *Gyrodactylus shariffi* sp. n. 5. Hamulus. 6. Ventral bar. 7. Penis. Scale bar = 10  $\mu$ m. 8. Marginal hook. Scale bar = 5  $\mu$ m.

African continent, suggesting that *G. niloticus* sp. n. arrived in the Philippines along with host shipments originating in Africa. The haptor sclerites of *G. niloticus* sp. n. resemble most closely those of *G. cichlidarum*, in both species having hamuli, ventral bars, and marginal hook sickles of similar shape and proportions. However, *G. niloticus* sp. n. is easily separated from this species by its much smaller hamuli (59–66  $\mu$ m versus 80–100  $\mu$ m in *G. cichlidarum*).

#### *Gyrodactylus shariffi* sp. n. (Figs. 5–8)

DESCRIPTION (based on 10 flattened specimens): Body 240–383 (289.7  $\pm$  43.9) long, 48–96 (76.6  $\pm$  13.5) wide at middle. Pharynx 20–39 (26.2  $\pm$  6.0) long, 22–43 (30.7  $\pm$  6.4) wide. Penis 9–12 (10.1  $\pm$  1.1) ( $n$  = 8) in diameter, with a single large spine and a row of 5 or 6 small spines. Hamuli stout, 44–48 (45.3  $\pm$  1.6) long; root 8–14 (10.8  $\pm$  2.3), shaft 35–38 (36.5  $\pm$  1.1), point 17–21 (19.6  $\pm$  1.1) ( $n$  = 9). Ventral bar 5 (5.0  $\pm$  0.0) long, 18–22 (20.2  $\pm$  1.0) wide, with prominent, rounded anterolateral processes 7–10 (9.0  $\pm$  0.9) ( $n$  = 9) long. Ventral bar membrane 11–15 (14.0  $\pm$  1.2) long. Dorsal bar 14–20 (17.0  $\pm$  2.0) ( $n$  = 9) long. Marginal hook 18–21 (19.5  $\pm$  1.0) long. Sickle compact, 3–4 (3.8  $\pm$  0.4) long, 3–4 (3.2  $\pm$  0.4) wide proximally, 3–4 (3.2  $\pm$  0.4) wide distally. Handle 14–18 (15.8  $\pm$  1.1) long, with no terminal swelling. Filament 6–10 (7.6  $\pm$  1.3) long.

TYPE HOST: *Tilapia nilotica*.

**TYPE LOCALITY:** Culture ponds at the University of the Philippines in the Visayas, Brackishwater Aquaculture Center, Leganes, Iloilo Province, Philippines.

**LOCATION:** Body surface.

**TYPE SPECIMENS:** Holotype (No. 84009) and paratype specimens (No. 84010) are deposited in the United States National Museum, Beltsville, Maryland.

**COLLECTION DATE:** August 1985, December and January 1986.

**ETYMOLOGY:** This species is named in honor of Dr. M. Shariff, Universiti Pertanian Malaysia, Serdang, Malaysia, in recognition of his contributions to fish parasitology in Southeast Asia.

**COMMENTS:** *Gyrodactylus shariffi* sp. n. resembles most closely *G. zhukovi* Ling, 1962, described from the skin of *Mugil soiuy* in China (Ling, 1962; Zhukov, 1970). Both species belong to a lineage characterized by huge anterolateral processes of the ventral bar, relatively short stout hamuli, and marginal hooks with minute compact sickles. It appears to be a lineage that occurs on mugilid fishes in the Pacific Ocean basin because one of us (D.K.C.) has collected a similar species from *Mugil cephalus* in brackish water in coastal Peru. *Gyrodactylus shariffi* sp. n. differs from *G. zhukovi* by having much smaller hamuli (44–48  $\mu$ m versus 62  $\mu$ m).

### Discussion

There is considerable international interest in the manner in which fish parasites are being disseminated globally by humans (Hoffman, 1970; Bauer and Hoffman, 1976; Combes and LeBrun, 1990; Arthur and Shariff, 1991; Bauer, 1991; Lumanlan et al., 1992; Kennedy, 1993; Cone et al., 1994). The present study suggests that tilapia introduced into the Philippines brought with them at least 1 species of gyrodactylid parasite (*G. niloticus* sp. n.) in addition to the 8 species of parasites previously believed to have been introduced with this fish (Bondad-Reantaso and Arthur, 1990).

The presence of *G. shariffi* sp. n. on *T. nilotica* cultured in brackish water cages suggests that Nile tilapia may have picked up the infections from wild marine fishes that also inhabit the ponds. Mulletts are plentiful in coastal waters of the Philippines (see Schroeder, 1980) and are the most likely reservoir hosts, given the known association of this particular lineage of *Gyrodactylus* with members of the Mugilidae in the Pacific Ocean.

Bondad-Reantaso and Arthur (1990), in their survey of the parasites of wild and cultured *T. nilotica* in the Philippines, showed that the assemblages of parasites are made up of those species that were apparently introduced into the region along with the original host shipments and those that have been acquired secondarily from native fishes. This scenario parallels what we suspect has happened with the viviparous monogeneans.

### Literature Cited

- Arthur, R., and M. Shariff.** 1991. Towards international fish disease control in Southeast Asia. *Infish International* 3/91:45–48.
- Bauer, O. N.** 1991. Spread of parasites and diseases of aquatic organisms by acclimatization: a short review. *Journal of Fish Biology* 39:679–686.
- , and **G. L. Hoffman.** 1976. Helminth range extensions by translocation of fish. Pages 163–172 in L. A. Page, ed. *Wildlife Diseases*. Pergamon Press, New York.
- Bondad-Reantaso, M. G., and J. R. Arthur.** 1990. The parasites of Nile tilapia (*Oreochromis niloticus* (L.)) in the Philippines, including an analysis of changes in the parasite fauna of cultured tilapia from fry to market size. Pages 729–734 in R. Hirano and I. Hanyu, eds. *The Second Asian Fisheries Forum*, Asian Fisheries Society, Manila, Philippines.
- Combes, C., and N. LeBrun.** 1990. Invasions by parasites in continental Europe. Pages 285–296 in F. diCastro, A. J. Hansen, and M. Debussche, eds. *Biological Invasions in Europe and the Mediterranean Basin*. Kluwer Academic Publishers, Dordrecht.
- Cone, D. K., T. Eurell, and V. Beasley.** 1994. A report of *Dactylogyrus amphibothrium* (Monogenea) on the gills of European ruffe (*Gymnocephalus cernuus*) in western Lake Superior. *Journal of Parasitology* 80:476–478.
- Hoffman, G. L.** 1970. Intercontinental and transcontinental dissemination and transfaunation of fish parasites with emphasis on whirling disease. Pages 69–81 in S. F. Snieszko, ed. *A Symposium on Diseases of Fishes and Shellfishes*. American Fisheries Society Special Publication No. 5.
- Kennedy, C. R.** 1993. Introductions, spread and colonization of new localities by helminth and crustacean parasites in the British Isles: a perspective and appraisal. *Journal of Fish Biology* 43:287–301.
- Ling, M.** 1962. Notes of seven new parasitic species of monogenetic trematodes-*Gyrodactylus* from fresh-water fishes of China. *Acta Hydrobiologica Sinica* 2:67–76. (In Chinese, English summary.)
- Lumanlan, S. C., J. D. Albaladejo, M. G. Bondad-Reantaso, and J. R. Arthur.** 1992. Freshwater fishes imported into the Philippines: their parasite faunas and role in the international spread of parasitic diseases. Pages 323–335 in M. Shariff, R. P. Subasinghe, and J. R. Arthur, eds. *Diseases in Asian Aquaculture I*. Fish Health Section, Asian Fisheries Society, Manila, Philippines.

- , and J. R. Arthur. 1992. Part 6: Philippines. Pages 91–145 in J. R. Arthur, ed. Asian Fish Health bibliography and Abstracts I: Southeast Asia. Fish Health Section, Asian Fisheries Society, Special Publication No. 1.
- Malmberg, G. 1970. The excretory systems and the marginal hooks as a basis for the systematics of *Gyrodactylus* (Trematoda, Monogenea). *Arkiv für Zoologi* 23:1–235.
- Mayes, M. A., and D. R. Brooks. 1977. *Gyrodactylus plotosi* n. sp. (Trematoda: Monogenea) from the silurid fish *Plotosus lineatus* from the Philippines. *Transactions of the American Microscopical Society* 96:143–145.
- Natividad, J. M., M. G. Bondad-Reantaso, and J. R. Arthur. 1986. Parasites of Nile tilapia (*Oreochromis niloticus*) in the Philippines. Pages 255–259 in J. L. MacLean, L. B. Dizon, and L. V. Hosillos, eds. The First Asian Fisheries Forum. Asian Fisheries Society, Manila, Philippines.
- Paperna, I. 1968. Monogenetic trematodes collected from fresh water fish in Ghana. Second Report. *Bamidgeh* 20:88–99.
- Schroeder, R. E. 1980. Philippine shore fishes. NMCP Books, Manila, Philippines. 266 pp.
- Zhukov, E. V. 1970. New species of trematodes and monogeneans from marine fishes of Posjet Bay (the Sea of Japan). *Parazitologiya* 4:321–326. (In Russian, English summary.)

J. Helminthol. Soc. Wash.  
62(1), 1995, p. 9

### *Parasite Lives Available*

*Parasite Lives, Papers on Parasites, Their Hosts and Their Associations, to Honor J.F.A. Sprent*, edited by M. Cremin, paperback. 1986. This book contains 15 research papers on parasites, hosts, and parasite–host interactions. If you wish to obtain a copy, please send Aus\$5.00 with your request to: Mrs. E. A. Weston, Department of Parasitology, The University of Queensland, Brisbane, Queensland 4072, Australia.

### *Parasitic Case of the Month*

*Parasitic Case of the Month* now consists of 36 cases of parasitic diseases in humans. The format consists of a brief clinical description illustrated with colored projection slides. Several questions and answers are also in the descriptive material. A total of 84 slides are included. The material is intended to enhance the teaching of parasitology at all levels.

The total cost of the series, including the 84 projection slides and postage within the United States and Canada, is \$100, payable to: Herman Zaiman, P.O. Box 543, Valley City, North Dakota 58072.